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INTERCOMPARISON OF LONG TERM SINGLE-COLUMN MODEL SIMULATIONS OF CLOUDS AT THE ARM SGP SITE

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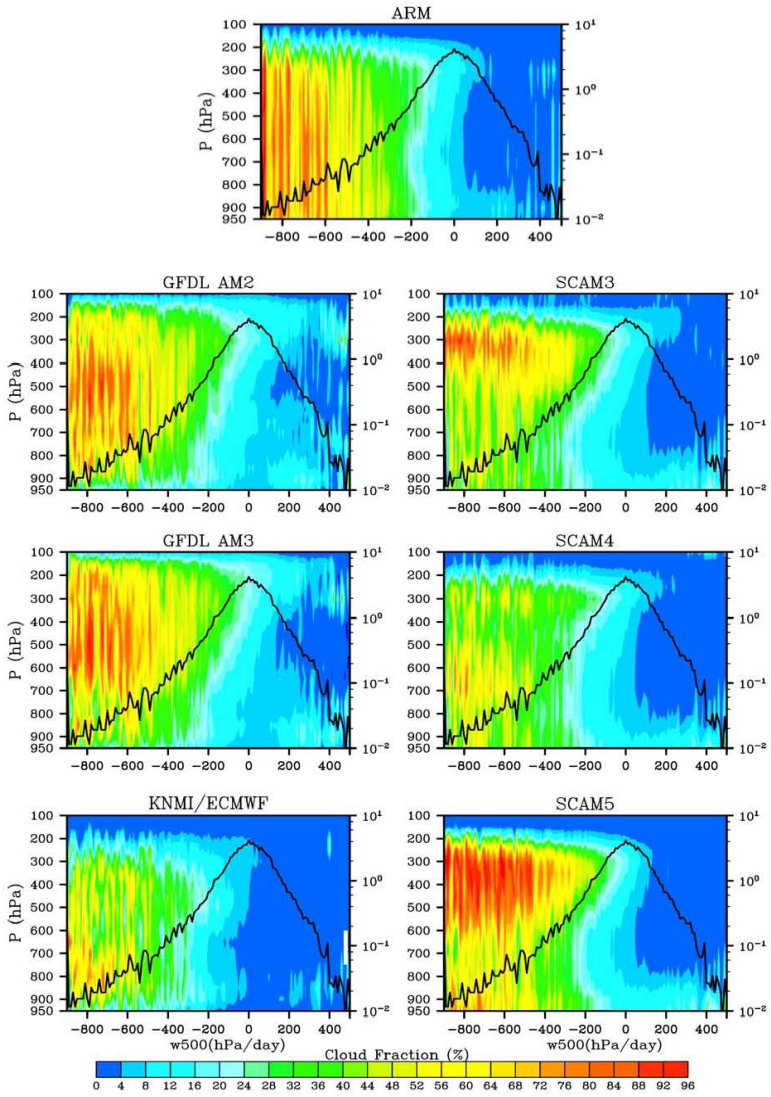
ABSTRACT

This study quantitatively evaluates the overall performances of six SCMs by comparing simulated clouds with observations at the ARM SGP site. The six SCMs from GFDL AM2 and AM3, KNMI/ECMWF, and NCAR CAM3, CAM4 and CAM5, are forced with the three-year (January 1999-Decmber 2001) continuous large-scale forcing data. The observed and simulated clouds are sorted by 500hPa vertical pressure velocity and precipitation, to assess the model skills in distinct dynamical regimes and to partition the influences of convective and stratiform parameterization schemes on model clouds. Results show that precipitations in models are largely constrained by the large-scale forcings, with slight underestimation of the observed precipitation under the strongly forced ascending regime. However, there are large differences in cloud fraction distributions between SCMs and ARM observation under both ascending and descending regimes. The cloud distributions binned by convective precipitation are significantly different from those binned by stratiform precipitation in that the cloud amount associated with convective precipitation is much smaller and vertically has higher degree of inhomogeneity. Qualitatively this is consistent with the fundamental assumptions in cloud parameterizations. However, the results also show that different models attribute the precipitation to convective and stratiform processes very differently, suggesting there still has a long way to go for reasonable partitioning of convective and stratiform precipitation.



PDF of 500hPa vertical pressure velocity (black line, right Y-axis). The average cloud fraction (shaded, left Y-axis) binned by 500hPa omega (10hPa/day bins) in ARM obs. and SCMs. Units of omega, PDF of omega and cloud fraction are hPa/day, % and % respectively.